

In the Claims:

Please cancel claims 1-22. The claims are as follows:

1 - 22 Canceled

23. (Previously Presented) A method for of aligning a mask to a substrate comprising in the order recited:

- (a) placing a bottom ring of an alignment fixture on an alignment tool;
- (b) loading a substrate onto a chuck;
- (c) securing said substrate on said chuck;
- (d) locating alignment targets on said substrate relative to fixed positions of a first X-Y stage and a rotational stage mounted on said first X-Y stage;
- (e) placing said mask on said bottom ring and placing a top ring of said alignment fixture on said mask, said top ring aligned to said bottom ring;
- (f) applying a clamping force of a first predetermined amount of force to said alignment fixture sufficient to prevent said mask from moving relative to said top and bottom rings;
- (g) locating alignment marks on said mask relative to a fixed position of a second X-Y-stage, said first X-Y stage and said table mounted to said second X-Y stage, X and Y orthogonal displacement directions associated with each of said first and second X-Y stages being co-aligned;
- (h) calculating an X distance in said X direction and a Y distance in said Y direction to move said first X-Y stage and an angle to rotate said rotational stage through in order to align said alignment marks to said alignment targets;

(i) increasing the applied clamping force to a second predetermined amount of force, releasing said substrate from said chuck, and increasing the applied clamping force to a third predetermined amount of force;

(j) temporarily fastening said alignment fixture containing said mask and said substrate together; and

(k) releasing said applied clamping force.

24. (Previously Presented) The method of claim 23, further including after step (e) passing alignment pins contained in at least two mask alignment pin mechanisms mounted to said table through openings in said table and said bottom and top rings and engaging mask alignment holes in said mask.

25. (Previously Presented) The method of claim 23, wherein in steps (f) and (i) said first, second and third predetermined clamping forces are uniformly distributed along a perimeter of said alignment fixture.

26. (Previously Presented) The method of claim 23, wherein step (j) further includes simultaneously inserting removable spring clips onto lower portions of retaining posts extending below said bottom ring, said retaining posts fixed in and extending from said top ring and through retaining post holes in said mask and retaining post holes in said bottom ring.

27. (Previously Presented) The method of claim 26, wherein step (j) further includes compressing said removable spring clips prior to insertion of said removable spring clips onto said retaining posts.

28. (Previously Presented) The method of claim 23, further including after step (c) moving said first X-Y stage a first predetermined X distance in said X direction and a first predetermined Y distance in said Y direction and rotating said rotational stage through a predetermined angle.

29. (Previously Presented) The method of claim 23, further including after step (f) moving said second X-Y stage a second predetermined X distance in said X direction and a second predetermined Y distance in said Y direction.

30. (Previously Presented) The method of claim 23, wherein step (h) further includes determining locations of center points of alignment targets on said substrate alignment marks on said mask relative to a fixed position of said stage assembly using said pattern recognition system and calculating a distance to move said stage assembly in said first orthogonal direction, a distance to move said stage assembly in said second orthogonal direction and a angle to rotate said stage assembly through using said computer in order to align said center points of said alignment targets with said center points of said alignment marks.

31. (Previously Presented) The method of claim 23, wherein:

said bottom ring includes an inner lip for supporting an interior region of said substrate and an outer lip for supporting a peripheral region of said mask, said inner lip higher than said outer lip;

retaining posts fixed in and extending from said top ring and through retaining post holes in said bottom ring;

removable spring clips engaging said retaining posts; and

when said removable spring clips are engaged in said retaining posts, said top ring presses said peripheral portion of said mask against said outer lip.

32. (Previously Presented) The method of claim 23, wherein said mask is a metal solder bump evaporation mask and said substrate is a semiconductor wafer.

33. (Previously Presented) A method for of aligning a mask to a substrate comprising in the order recited:

(a) providing an alignment fixture for temporarily holding said mask and said substrate in fixed positions relative to each other;

(b) providing an alignment tool including a stage assembly and a table;

(c) placing a bottom ring of said alignment fixture on said table;

(d) securing said substrate on said chuck and locating alignment targets on said substrate relative to a fixed position of said stage assembly,

(e) placing said mask on said bottom ring and placing a top ring of said alignment fixture on said mask, said top ring aligned to said bottom ring;

(f) applying a affixing force of a first predetermined amount of force to said alignment fixture sufficient to prevent said mask from moving;

(g) locating alignment marks on said mask relative to a fixed position of said stage assembly;

(h) moving said substrate relative to said mask in order to align said alignment marks to said alignment targets;

(i) increasing the applied affixing force to a second predetermined amount of force, releasing said substrate from said chuck, increasing the applied affixing force to a third predetermined amount of force;

(j) temporarily fastening said alignment fixture containing said mask and said substrate together; and

(k) releasing said applied affixing force.

34. (Previously Presented) The method of claim 33, wherein said first and second directions are orthogonal to each other and parallel to said table.

35. (Previously Presented) The method of claim 1, wherein said axis is perpendicular to said table.

36. (Previously Presented) The method of claim 33, wherein said alignment tool further includes an additional stage assembly moveable in said first and second directions, said stage assembly and said table mounted on said additional stage assembly, movement of said additional stage assembly in said first and second directions controlled by said means for aligning.

37. (Previously Presented) The method of claim 33, wherein said means for holding said substrate is a vacuum chuck including a circular array of O-rings adjacent to a perimeter of said vacuum chuck, each O-ring extending above a top surface of said chuck and surrounding a vacuum port.

38. (Previously Presented) The method of claim 37, wherein said alignment tool further includes means for releasing vacuum pressure applied to said vacuum chuck when said affixing force reaches a predetermined value.

39. (Previously Presented) The method of claim 33, further including after step (f) passing alignment pins contained in at least two mask alignment pin mechanisms mounted to said table through openings in said table and said alignment fixture and engaging mask alignment holes in said mask.

40. (Previously Presented) The method of claim 39, wherein said alignment pins are spring loaded and can move in a third direction perpendicular to said table.

41. (Previously Presented) The method of claim 39, wherein said mask alignment holes comprise a circular alignment hole and a slot.

42. (Previously Presented) The method of claim 39, wherein said mask alignment holes are diametrically opposed.

43. (Previously Presented) The method of claim 33, wherein said means for temporarily affixing comprise two or more clamping mechanisms that are uniformly spaced around a perimeter of said alignment fixture and said first, second and third predetermined affixing forces are uniformly distributed along said perimeter of said alignment fixture.

44. (Previously Presented) The method of claim 43, wherein said clamping mechanisms further include clamping fingers for compressing and clamping said alignment fixture and push rods for moving said clamping fingers.

45. (Previously Presented) The method of claim 44, wherein said push rods are simultaneously activated by a rotatable ring moveable in a third direction perpendicular to said table.

46. (Previously Presented) The method of claim 33, wherein step (j) further includes temporarily inserting removable spring clips onto lower portions of retaining posts extending below a bottom ring of said alignment fixture, said retaining posts fixed in and extending from a top ring portion of said alignment fixture and through retaining post holes in said mask and retaining post holes in said bottom ring.

47. (Previously Presented) The method of claim 46, wherein said removable spring clips are simultaneously inserted onto said retaining posts.

48. (Previously Presented) The method of claim 33, wherein step (j) further includes compressing said removable spring clips prior to insertion of said removable spring clips onto said retaining posts.

49. (Previously Presented) The method of claim 33, wherein step (h) further includes determining locations of center points of alignment targets on said substrate alignment marks on said mask relative to a fixed position of said stage assembly using said pattern recognition system and calculating a distance to move said stage assembly in said first direction, a distance to move said stage assembly in said second direction and a angle to rotate said stage assembly through using said computer in order to align said center points of said alignment targets with said center points of said alignment marks.

50. (Previously Presented) The method of claim 33, wherein said alignment fixture comprises:

- a top ring;

- a bottom ring having an inner lip for supporting an interior region of said substrate and an outer lip for supporting a peripheral region of said mask, said inner lip higher than said outer lip;

- retaining posts fixed in and extending from said top ring and through retaining post holes in said bottom ring;

- removable spring clips engaging said retaining posts;

- wherein said top ring presses said peripheral portion of said mask against said outer lip when said alignment fixture is assembled.

51. (Previously Presented) The method of claim 33, wherein

steps (d) further includes controlling vacuum pressure to said chuck using said computer;
step (e) further includes controlling the amount of force exerted by said means for affixing using said computer; and
step (i) further includes controlling the operation of said means for temporarily fastening using said computer.

52. (Previously Presented) The method of claim 33, wherein said mask is a metal mask.

53. (Previously Presented) The method of claim 33, wherein said substrate is a semiconductor wafer.

54. (Previously Presented) The method of claim 33, wherein said mask is a solder bump evaporation mask.

55. (Previously Presented) The method of claim 33, wherein said alignment tool further comprises:

means for holding said substrate at a bottom surface of said substrate, said means for holding protruding through an opening in said table and an opening in said alignment fixture, said means for holding fixedly mounted on said stage assembly, said stage assembly moveable in first and second directions and rotatable about an axis relative to said table;

means for temporarily affixing said alignment fixture containing said mask and said substrate to said table, said means for temporarily affixing applying a substantially uniform force around a perimeter of said alignment fixture;

a pattern recognition system including a camera and a computer, said computer controlling movements of said stage assembly in said first and second directions and rotational movement; and

means for temporarily fastening said alignment fixture together.